



Morphological Study of Menisci of Knee Joint in Human Cadavers

¹Dr. Manish Gupta, ²Dr. Pawan Kumar Mahato and ³Dr. Akanksha Sharma

^{1,3}Department of Anatomy, Index Medical College Hospital and RC, Indore (MP), India

²Department of Anatomy, SSIMS, Bhilai (CG), India

OPEN ACCESS

Key Words

Menisci, knee joint, morphometry, width, thickness

Corresponding Author

Dr. Akanksha Sharma,
Department of Anatomy, Index
Medical College Hospital and RC,
Indore (MP), India
Drakankshasharma1990@gmail.com

Author Designation

¹Tutor

²Professor

³Assistant Professor

Received: 25 September 2024

Accepted: 30 October 2024

Published: 9 December 2024

Citation: Dr. Manish Gupta, Dr. Pawan Kumar Mahato and Dr. Akanksha Sharma, 2025. Morphological Study of Menisci of Knee Joint in Human Cadavers. Res. J. Med. Sci., 19: 20-23, doi: 10.36478/makrjms.2025.1.20.23

Copy Right: MAK HILL Publications

ABSTRACT

Menisci are fibrocartilaginous discs located between the femur and tibia in the knee joint. They are weight-bearing structures that are often damaged and may require replacement via arthroscopic or open procedure. The medial and lateral menisci show distinct morphological differences, with variations in thickness and width influencing injury mechanisms. However, data on meniscal morphology are limited. To measure the length of the meniscus from the anterior horn to the posterior horns between the right and left knee. The study involved 60 menisci (30 knee joints) from adult cadavers. An incision was made to remove the skin, soft tissues and muscles for proper cleaning. A black ink marker outlined all attachments. The length of the meniscus from the anterior to posterior horns was measured with non-elastic thread. Distances between the horns were measured using a digital calliper, placed between their apexes. THE Width was assessed at the anterior third, middle third and posterior third, while thickness was measured at the same points using the calliper on the outer circumference. The distance between the anterior and posterior horns of the right knee was significantly greater at 28.9 ± 1.3 compared to the left knee, which measured 28.2 ± 1.5 . The thickness of the meniscus in the left knee was recorded as 3.1 ± 1.0 for the anterior third and 5.1 ± 0.9 for both the middle and posterior thirds. Additionally, the medial outer and inner lengths between the anterior and posterior horns of the right knee were 80.4 ± 1.4 and 46.6 ± 0.9 , respectively. The findings of this study support Interventionists performing advanced orthopaedic surgeries such as arthroscopy, knee transplants, meniscal transplants and meniscectomy. Understanding meniscal morphometry is important for diagnosis and treatment. Normal meniscus variants are rare and often asymptomatic, though discoid menisci have a higher risk of tearing.

INTRODUCTION

The knee joint is the largest synovial joint in the body, consisting of two condylar joints between the femur and tibia, separated by menisci. The meniscus is a fibrocartilaginous structure that helps maintain the integrity of the knee's articular cartilage and contributes to overall joint health. Composed of water (72%) and collagen (22%), the meniscus has a dense extracellular matrix with interspersed cells. The remaining dry weight is made up of proteoglycans, non-collagenous proteins, and glycoproteins. The cells of the menisci, known as fibro chondrocytes, exhibit characteristics of both fibroblasts and chondrocytes. The semicircular medial meniscus is wider at the back than at the front, with its anterior horn attached to the tibial plateau near the intercondylar fossa, anterior to the anterior cruciate ligament. (fig. 1)^[1]. The posterior horn is attached to the posterior condylar fossa of the tibia between the lateral meniscus and posterior cruciate ligament. (Fig. 1). The lateral meniscus is nearly circular with an approximate uniform width from anterior to posterior. Menisci have several functions such as maintaining congruency, load transmission, increase in joint contact area, decrease in joint contact stress, shock absorption, lubrication and limitation of extreme movements^[2]. Menisci have important functions but are often injured. Injuries to the menisci can disrupt the normal anatomy of the knee joint and lead to early joint damage. To successfully restore the menisci and maintain the knee joint's congruity, morphometric parameters such as thickness, width, length of the outer circumference of the menisci and the distance between the anterior and posterior horn of both menisci are important^[1].

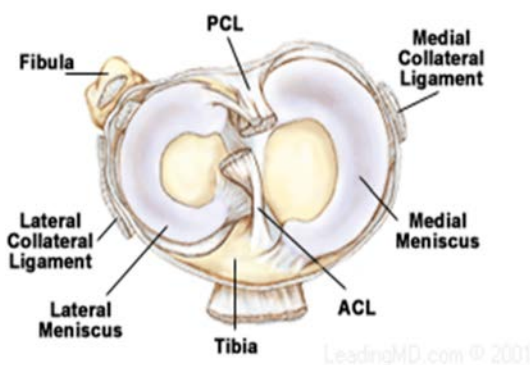


Fig. 1: Superior View of Tibia Showing the Attachment of Menisci

MATERIALS AND METHODS

This study was conducted after obtaining permission from the Institutional Ethical Committee from Index Medical College, Hospital Research Centers, Indore, (MP). All embalmed cadavers at the Department of Anatomy available during the study were included for data collection. Previously operated in the lower limb region, cadavers having musculoskeletal abnormalities

in the lower limb region were excluded from the study. The menisci were dissected first by making a longitudinal incision in the anterior side of the joint capsule. Then, the patellar ligament and collateral ligaments were cut transversely. After removing the intra-articular ligament and the joint capsule, the menisci were exposed. Carefully, the menisci were removed and detached from the femoral condyles and tibial plateau^[3]. All the measurements were taken by a digital calliper. (Fig. 2).



Fig. 2: A Digital Calliper

RESULTS AND DISCUSSIONS

Out of 30 cadaver knees, the mean deviation of the right knee was medial 28.9mm and lateral 11.5±0.6, and the left knee was 28.2±1.5 medial and 11.7±1.4 lateral. The minimum and maximum SD of the right and left knee is given in (Table 1).

Table 1: Distance Between Anterior and Posterior Horn of Left and Right Knee

			Mean±SD	Minimum	Maximum
Distance between anterior and posterior Horn (mm)	Right knee	Medial	28.9±1.3	26	31
	Left knee	Lateral	11.5±0.6	10	13
		Medial	28.2±1.5	25	31
		Lateral	11.7±1.4	10	14

The purpose of this study was to measure the dimensions of the medial meniscus using morphometric parameters such as width and thickness and compare the distance between the anterior and posterior horn medial and lateral of both the right and left knee. The collected data was organized systematically and the values were tabulated and analyzed. (Table 2, 3, 4).

Meniscus injury is common in day-to-day life in addition to sports., they are exposed to injury which may occur as part of a rotational trauma, bending, joint degenerative process or spontaneous injury^[4]. Loss of a meniscus leads to a significant increase in the risk of developing arthritis in the knee. To reduce the process of knee degeneration after meniscectomy, meniscus allograft transplantation has been considered a preferred choice^[4]. Several authors have conducted studies on the morphological parameters of the menisci of the knee joint over time. Among them,

Table 2: Width of Meniscus

Width of Meniscus (mm)			Mean ±SD	Minimum	Maximum
Right Knee medial	Ant.1/3		5±0.6	3	6
	Mid. 1/3		6.1±0.8	5	9
	Post. 1/3		10±1.5	6	14
Right knee Lateral	Ant.1/3		5.7±0.5	4	7
	Mid. 1/3		8.2±0.9	6	10
	Post. 1/3		8.9±0.8	8	11
Left Knee Medial	Ant.1/3		5.2±0.9	4	8
	Mid. 1/3		6.4±0.9	5	9
	Post. 1/3		9.8±1.2	6	12
Left knee Lateral	Ant.1/3		5.9±0.6	5	7
	Mid. 1/3		8.3±0.9	6	11
	Post. 1/3		9.2±0.8	7	11

Table 3: Thickness of Meniscus

Width of Meniscus (mm)			Mean ±SD	Minimum	Maximum
Right Knee medial	Ant.1/3		2.4±0.4	1	3
	Mid. 1/3		4.4±0.9	2	6
	Post. 1/3		4.5±0.7	3	6
Right knee Lateral	Ant.1/3		2.4±0.6	1	4
	Mid. 1/3		5.1±0.8	3	7
	Post. 1/3		5.8±0.8	4	7
Left Knee Medial	Ant.1/3		3.1±1.02	2	6
	Mid. 1/3		5.1±0.94	4	8
	Post. 1/3		5.1±0.9	3	8
Left knee Lateral	Ant.1/3		2.9±0.8	2	6
	Mid. 1/3		5.1±0.8	3	7
	Post. 1/3		5.9±0.72	4	8

Table 4: Compare the Distance Between Anterior and Posterior Horn Medial and Lateral of Both Right and Left Knee

			Mean ±SD	P-value
Distance between anterior and posterior Horn (mm)	Right knee	Medial	28.9±1.3	<0.001
		Lateral	11.5±0.63	
	Left knee	Medial	28.2±1.5	
		Lateral	11.7±0.78	

more comprehensive studies on menisci were carried out by Almeida^[5], Rao^[6], Braz^[7] and Bhatt^[8]. The present study noted that the medial distance between the anterior and posterior horn right knee was 28.9±1.3 which was significantly higher than the medial distance between the anterior and posterior horn left knee was 28.18±1.46 (P<0.05). The lateral distance between the anterior and posterior horn right knee was 11.5±0.6 which was insignificantly lower than the lateral distance between the anterior and posterior horn left knee 11.7±0.8 (p>0.005). The average distance between the anterior and posterior horn (in mm) of the medial right knee was 28.9±1.3, the lateral right knee was 11.5±0.6, the medial left knee was 28.18±1.46 and the lateral left knee was 11.7±0.8 mm. When we calculate the average of left and right medial and left and right lateral distance between the anterior and posterior horn, we noted 28.6±1.3 and 11.6±0.6 mm respectively. Braz PRP and Silva^[7] and Ashwini^[9] reported significantly higher distance for the medial meniscus between two horns than the lateral meniscus. The findings of our study are consistent with the studies cited above. This greater proximity of the horns of the lateral meniscus may explain why they are less prone to injury. Length between anterior and posterior horn in this study was right knee medial outer and inner was 28.92±1.33mm and 11.51±0.63 mm respectively and right knee lateral outer and inner was 67.65±0.98mm and 43.64±1.00mm respectively. Similarly in the left knee medial outer and inner were

80.77±1.33mm and 47.05±0.96mm respectively and left knee lateral outer and inner were 67.69±0.96mm and 43.98±0.99mm respectively. In a comparable study, Murlimanju^[10] length of the medial meniscus is 75.2±0.7mm and that of the lateral meniscus is 68.0±1.2 mm. In another study Panigrahi^[11] reported the length of the medial menisci of both right (78.0 mm) and left (75.0 mm) was found to be more when compared to lateral menisci (right-58.3mm, left-50.0 mm).

Limitations of This Study: The present study was constrained by the limited availability of cadavers and the use of specimens of unknown age and sex. Some cadavers had been preserved for a prolonged period, impacting the accuracy of the measurements. Furthermore, the study relied on a simplistic linear measurement technique for a nonlinear structure. A more extensive radiological, clinical and anatomical study from other regions is imperative for robust support.

CONCLUSION

Interventionists for Performing advanced orthopaedic surgeries arthroscopy, knee-transplant surgery, meniscal transplant surgery and meniscectomy. This anatomical knowledge of meniscal morphometry is useful for diagnostic and therapeutic procedures. Normal variants of the meniscus are relatively uncommon and are frequently asymptomatic, although

there is a greater propensity for discoid menisci to tear. However, recognizing these variants is important, as they can be misinterpreted for more significant pathology on MRI. Therefore, health professionals who work with the treatment of meniscal injuries should be aware of the possible anatomical variations that may exist in the meniscus facilitating the rehabilitation process.

REFERENCES

1. Muthusamy, S., Y.A. Sontakke and A. K, 2019. Morphometry of Knee Menisci. *J. Adv. Res. Med. & Health Sci.* (ISSN: 2208-2425), 5: 2208-2425.
2. Rohila, J., S.K. Rathee, S.K. Dhatarwal and Z.S. Kundu, 2017. Morphometric analysis of menisci of adult human knee joint in North Indian population. *Int. J. Res. Med. Sci.*, 5: 569-573.
3. Subramanian, S. and A.P. Balakrishnan, 2023. A Study on the Morphometry of a Medial Meniscus in the Knee Joint of Human Cadavers in the South Indian Population. *Cureus*, Vol. 15 .10.7759/cureus.42753.
4. Camanho, G.L., 2009. Lesão meniscal por fadiga. *Acta Ortopédica Bras.*, Vol. 17 .10.1590/s1413-78522009000100006.
5. Almeida, K.S.D., S.R.A. de Moraes, T. Tashiro, E.D. Neves, A.E. Toscano and R.M.R. de Abreu, 2004. Morphometric study of menisc of the knee joint. *Int. J. Morphology*, 22: 181-184.
6. Rao, N., A.D. Gupta and R.A. V, 2014. Morphometric analysis of the menisci of the knee joint in population of east godavari region of andhra pradesh. *J. Evol. Med. Dent. Sci.*, 3: 8972-8979.
7. Braz, P.R.P. and W.G. Silva., 2010. 1. Meniscus Morphometric Study in human., *J Morphol Sci.*, 279: 62-66.
8. Bhatt, C.R., B. Prajapati, K. Suthar and C.D. Mehta., 2014. 1. Morphometric study of menisci of the knee joint in the west region. *International Journal of Basic and Applied Medical Sciences.*, 4: 95-99.
9. Ashwini, C., C.M. Nanjaiah, G.S. Saraswathi and N.M. Shamsundar., 2013. 1. Morphometric study of menisci of human knee joint. *Int J Cur Res Rev.*, 5: 118-125.
10. Murlimanju, B.V., N. Nair, S. Pai, M. Pai, P. Chethan and C. Gupta., 2010. 1. Morphological study of the menisci of the knee joint in the adult cadavers of the South Indian population. *MMJ.*, 23: 270-275.
11. Panigrahi, M. and S.S. Kumar., 2013. 1. Morphometric Analysis of Adult Menisci-A Cadaveric Study. *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS).*, 11: 40-43.